

**PATENT APPLICATION**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

T. YAMAMOTO et al.

Group Art Unit: Unknown

Application No.: Not Yet Assigned

Examiner: Unknown

Filed: Concurrently Herewith

Attorney Dkt. No.: 108384-00041

For: SURFACE TREATED COPPER FOIL, ELECTRODEPOSITED COPPER FOIL  
WITH CARRIER, MANUFACTURE METHOD FOR THE ELECTRODEPOSITED  
COPPER FOIL WITH CARRIER, AND COPPER CLAD LAMINATE

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
Washington, D.C. 20231

February 7, 2002

Sir:

Prior to initial examination of the application, please amend the above-identified  
application as follows:

**IN THE CLAIMS:**

Please amend claims 17-22, 24 and 25 as follows:

17. (Amended) The electrodeposited copper foil with carrier for processing for laser  
hole formation as claimed in claim 11, wherein the organic agent to be employed for the  
release layer is one or more compounds selected from nitrogen-containing organic  
compounds, sulfur-containing organic compounds, and carboxylic acids.


18. (Amended) The electrodeposited copper foil with carrier for processing for laser hole formation as claimed in claim 11, wherein the release layer is formed by applying one of organic agent or a mixture of two or more organic agents selected from nitrogen-containing organic compounds, carboxylic acids repeatedly a plurality of times.
19. (Amended) The electrodeposited copper foil with carrier for processing for laser hole formation as claimed in claim 11, wherein the release layer is formed by reciprocally and repeatedly applying two or more organic agents selected from nitrogen-containing organic compounds, sulfur-containing organic compounds, and carboxylic acids.
20. (Amended) The electrodeposited copper foil with carrier for processing for laser hole formation as claimed in claim 11, wherein the release layer is of an organic film with a thickness of 1nm to 1 $\mu$ m.
21. (Amended) The electrodeposited copper foil with carrier as claimed in claim 5, wherein the carrier foil is an electrodeposited copper foil having a matte side with a roughness (Rz) of 0.05  $\mu$ m to less than 4.0.  $\mu$ m.
22. (Amended) The electrodeposited copper foil with carrier for processing for laser hole formation as claimed in claim 8, wherein the carrier foil is an electrodeposited copper foil having a matte side with a roughness (Rz) of 4.0.  $\mu$ m to 20.0  $\mu$ m.
24. (Amended) A copper clad laminate obtained using the surface treated copper foil for processing for laser hole formation as claimed in claim 1.
25. (Amended) A copper clad laminate obtained using the electrodeposited copper foil with carrier for processing for laser hole formation as claimed in claim 5.

## REMARKS

Claims 1-25 are pending in this application. By this Amendment, claims 17-22, 24 and 25 are amended to delete multiple dependency. No new matter is contained in the amendments.

Please charge any fee deficiency or credit any overpayment to Deposit Account No. 01-2300.

Respectfully submitted,



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# MARKED UP CLAIMS

## CLAIMS

1. A surface treated copper foil for a printed circuit board produced from a copper foil with one side roughened, wherein the copper foil is a surface treated copper foil for processing for laser hole formation and provided with a nickel layer with a thickness of 0.08 to 2.0  $\mu\text{m}$  as an additional metal layer in one side and subjected to a nodular treatment by fine copper particles in another side.

2. A surface treated copper foil for a printed circuit board produced from a copper foil with one side roughened, wherein the copper foil is a surface treated copper foil for processing for laser hole formation and provided with a cobalt layer with a thickness of 0.05 to 3.0  $\mu\text{m}$  as an additional metal layer in one side and subjected to a nodular treatment by fine copper particles in another side.

3. A surface treated copper foil for a printed circuit board produced from an electrodeposited copper foil obtained by electrolysis in a copper electrolytic solution and subjected to nodular treatment in one side, wherein the copper foil is a surface treated copper foil for processing for laser hole formation and provided with a nickel layer with a thickness of 0.05 to 2.0  $\mu\text{m}$  as an additional metal layer in a matte side of the electrodeposited copper foil and subjected to a nodular treatment by fine copper particles in a shiny side.

4. A surface treated copper foil for a printed circuit board produced from an electrodeposited copper foil obtained by electrolysis in a copper electrolytic solution and subjected to nodular treatment in one side, wherein the copper foil is

5 a surface treated copper foil for processing for laser hole formation and provided with a cobalt layer with a thickness of 0.03 to 3.0  $\mu\text{m}$  as an additional metal layer in a matte side of the electrodeposited copper foil and subjected to a nodular treatment by fine copper particles in a shiny side.

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5. An electrodeposited copper foil with carrier having a three-layer structure composed of a carrier foil layer, an additional metal layer, and an electrodeposited copper foil layer; wherein a carrier foil is of a metal material having

15 a smooth surface with a roughness (Rz) of 0.05 to less than 4.0  $\mu\text{m}$ , the additional metal layer is a nickel layer with a thickness of 0.08 to 2.0  $\mu\text{m}$  thickness formed in the smooth surface side of the carrier foil, and the electrodeposited copper foil layer composed of a bulk layer and fine copper

20 particles is formed in a surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

6. An electrodeposited copper foil with carrier having a

25 three-layer structure composed of a carrier foil layer, an additional metal layer, and an electrodeposited copper foil layer; wherein a carrier foil is of a metal material having a smooth surface with a roughness (Rz) of 0.05 to less than

4.0  $\mu\text{m}$ , the additional metal layer is a cobalt layer with a thickness of 0.05 to 3.0  $\mu\text{m}$  thickness formed in the smooth surface side of the carrier foil, and the electrodeposited copper foil layer composed of a bulk layer and fine copper particles is formed in a surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

7. An electrodeposited copper foil with carrier having a three-layer structure composed of a carrier foil layer, an additional metal layer, and an electrodeposited copper foil layer; wherein a carrier foil is of a metal material having a smooth surface with a roughness ( $R_z$ ) of 0.05 to less than 4.0  $\mu\text{m}$ , the additional metal layer is a nickel layer or a cobalt layer with a thickness of 0.03 to 1.0  $\mu\text{m}$  thickness formed in the smooth surface side of the carrier foil, and the electrodeposited copper foil layer comprising only fine copper particles is formed in a surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

8. An electrodeposited copper foil with carrier having a three-layer structure composed of a carrier foil layer, an additional metal layer, and an electrodeposited copper foil layer; wherein a carrier foil is of a metal material having a matte side with a roughness ( $R_z$ ) of 4.0 to 20.0  $\mu\text{m}$ , the additional metal layer is a nickel layer with a thickness of 0.05 to 2.0  $\mu\text{m}$  thickness formed in a matte side of the carrier

foil, and the electrodeposited copper foil layer composed of a bulk layer and fine copper particles is formed in a surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

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9. An electrodeposited copper foil with carrier having a three-layer structure composed of a carrier foil layer, an additional metal layer, and an electrodeposited copper foil layer; wherein a carrier foil is of a metal material having a matte side with a roughness (Rz) of 4.0 to 20.0  $\mu\text{m}$ , the additional metal layer is a cobalt layer with a thickness of 0.03 to 3.0  $\mu\text{m}$  thickness formed in the matte side of the carrier foil, and the electrodeposited copper foil layer composed of a bulk layer and fine copper particles is formed in a surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

10. An electrodeposited copper foil with carrier having a three-layer structure composed of a carrier foil layer, an additional metal layer, and an electrodeposited copper foil layer; wherein a carrier foil is of a metal material having a matte side with a roughness (Rz) of 4.0 to 20.0  $\mu\text{m}$ , the additional metal layer is a nickel layer or a cobalt layer with a thickness of 0.03 to 1.0  $\mu\text{m}$  thickness formed in the matte side of the carrier foil, and the electrodeposited copper foil layer comprising only fine copper particles is formed in a surface of the additional metal layer to be an

electrodeposited copper foil with carrier for processing for laser hole formation.

11. An electrodeposited copper foil with carrier composed  
5 of a release layer formed on a surface of a carrier foil and  
an additional metal layer and an electrodeposited copper foil  
layer formed on the release layer, wherein the carrier foil  
is of a film or a metal material having a smooth surface with  
a roughness (Rz) of 0.05 to less than 4.0  $\mu\text{m}$ , the release layer  
10 is formed using an organic agent or a metal material on the  
smooth face side of the carrier foil, a nickel layer with a  
thickness of 0.08 to 2.0  $\mu\text{m}$  thickness is formed as the  
additional metal layer on a surface of the release layer, and  
the electrodeposited copper foil layer comprising a bulk  
15 layer and fine copper particles is formed in a surface of the  
additional metal layer to be an electrodeposited copper foil  
with carrier for processing for laser hole formation.

12. An electrodeposited copper foil with carrier composed  
20 of a release layer formed on a surface of a carrier foil and  
an additional metal layer and an electrodeposited copper foil  
layer formed on the release layer, wherein the carrier foil  
is of a film or a metal material having a smooth surface with  
a roughness (Rz) of 0.05 to less than 4.0  $\mu\text{m}$ , the release layer  
25 is formed using an organic agent or a metal material on the  
smooth face side of the carrier foil, a cobalt layer with a  
thickness of 0.05 to 3.0  $\mu\text{m}$  thickness is formed as the  
additional metal layer on a surface of the release layer, and



the electrodeposited copper foil layer comprising a bulk layer and fine copper particles is formed in a surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

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13. An electrodeposited copper foil with carrier composed of a release layer formed on a surface of a carrier foil and an additional metal layer and an electrodeposited copper foil layer formed on the release layer, wherein the carrier foil is of a film or a metal material having a smooth surface with a roughness (Rz) of 0.05 to less than 4.0  $\mu\text{m}$ , the release layer is formed using an organic agent or a metal material on the smooth face side of the carrier foil, a nickel layer or a cobalt layer with a thickness of 0.03 to 1.0  $\mu\text{m}$  thickness is formed as the additional metal layer on the surface of the release layer, and the electrodeposited copper foil layer comprising only fine copper particles is formed in the surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

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14. An electrodeposited copper foil with carrier composed of a release layer formed on a surface of a carrier foil and an additional metal layer and an electrodeposited copper foil layer formed on the release layer, wherein the carrier foil is of a film or a metal material having a roughened face with a roughness (Rz) of 4.0 to 20.0  $\mu\text{m}$ , the release layer is formed using an organic agent or a metal material on the roughened face side of the carrier foil, a nickel layer with a thickness

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of 0.05 to 2.0  $\mu\text{m}$  thickness is formed as the additional metal layer on a surface of the release layer, and the electrodeposited copper foil layer comprising a bulk layer and fine copper particles is formed in the surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

15. An electrodeposited copper foil with carrier composed of a release layer formed on a surface of a carrier foil and an additional metal layer and an electrodeposited copper foil layer formed on the release layer, wherein the carrier foil is of a film or a metal material having a roughened face with a roughness (Rz) of 4.0 to 20.0  $\mu\text{m}$ , the release layer is formed using an organic agent or a metal material on the roughened face side of the carrier foil, a cobalt layer with a thickness of 0.03 to 3.0  $\mu\text{m}$  is formed as the additional metal layer on a surface of the release layer, and the electrodeposited copper foil layer comprising a bulk layer and fine copper particles is formed in a surface of the additional metal layer to be an electrodeposited copper foil with carrier for processing for laser hole formation.

16. An electrodeposited copper foil with carrier composed of a release layer formed on a surface of a carrier foil and an electrodeposited copper foil layer formed on the release layer, wherein the carrier foil is of a film or a metal material having a roughened face with a roughness (Rz) of 4.0 to 20.0  $\mu\text{m}$ , the release layer is formed using an organic agent or a

metal material on the roughened face side of the carrier foil,  
a nickel layer or a cobalt layer with a thickness of 0.03 to  
1.0  $\mu\text{m}$  thickness is formed as the additional metal layer on  
a surface of the release layer, and the electrodeposited  
5 copper foil layer comprising only fine copper particles is  
formed in a surface of the additional metal layer to be an  
electrodeposited copper foil with carrier for processing for  
laser hole formation.

10 17. The electrodeposited copper foil with carrier for  
processing for laser hole formation as claimed in claim 11  
[to claim 16], wherein the organic agent to be employed for the  
release layer is one or more compounds selected from  
nitrogen-containing organic compounds, sulfur-containing  
15 organic compounds, and carboxylic acids.

18. The electrodeposited copper foil with carrier for  
processing for laser hole formation as claimed in claim 11  
[to claim 16], wherein the release layer is formed by applying  
one of organic agent or a mixture of two or more organic agents  
20 selected from nitrogen-containing organic compounds,  
sulfur-containing organic compounds, and carboxylic acids  
repeatedly a plurality of times.

19. The electrodeposited copper foil with carrier for  
25 processing for laser hole formation as claimed in claim 11  
[to claim 16], wherein the release layer is formed by  
reciprocally and repeatedly applying two or more organic

agents selected from nitrogen-containing organic compounds, sulfur-containing organic compounds, and carboxylic acids.

20. The electrodeposited copper foil with carrier for processing for laser hole formation as claimed in <sup>claim 11</sup> any one of claim 11 to claim 19 wherein the release layer is of an organic film with a thickness of 1 nm to 1  $\mu\text{m}$ .

21. The electrodeposited copper foil with carrier as claimed in <sup>claim 5</sup> any one of claim 5, claim 6, claim 7, claim 11, claim 12, and claim 13 wherein the carrier foil is an electrodeposited copper foil having a matte side with a roughness (Rz) of 0.05  $\mu\text{m}$  to less than 4.0  $\mu\text{m}$ .

22. The electrodeposited copper foil with carrier for processing for laser hole formation as claimed in <sup>claim 8</sup> any one of claim 8, claim 9, claim 10, claim 14, claim 15, and claim 16, wherein the carrier foil is an electrodeposited copper foil having a matte side with a roughness (Rz) of 4.0  $\mu\text{m}$  to 20.0  $\mu\text{m}$ .

23. A manufacturing method for an electrodeposited copper foil with carrier comprising steps of unwinding a carrier foil rolled in a roll state in one direction and subjecting the carrier foil to electrodeposited copper foil layer formation processes properly equipped with water-rinsing treatment tanks by passing the carrier foil respectively through an pickling tank, a release layer formation tank using an organic

agent, a formation tank for forming a bulk copper layer to be the electrodeposited copper foil layer, a surface nodular treatment tank for forming fine copper particles on a surface of the bulk copper layer, an anti-corrosion treatment tank, and a drying part to continuously form the release layer of the organic agent and the electrodeposited copper foil layer on the carrier foil.

24. A copper clad laminate obtained using the surface treated copper foil for processing for laser hole formation as claimed in claim 1 [to claim 4].

25. A copper clad laminate obtained using the electrodeposited copper foil with carrier for processing for laser hole formation as claimed in claim 5 [to claim 22].